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Waste Analysis Plan for Single-Shell Tank Compatibility

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EXECUTIVE SUMMARY

This *Waste Analysis Plan for Single-Shell Tank Compatibility* describes the information and procedures required to evaluate the compatibility of pumpable mixed waste from the unstabilized single-shell tanks for interim storage in the double-shell tanks on the Hanford Site. The scope of the plan goes beyond the requirements for the Resource Conservation and Recovery Act. The scope of work defined will determine the type of mixed waste (complexed or noncomplexed, transuranic [TRU] or non-TRU), the transuranic resolubilization potential of selected noncomplexed waste, and the compatibility of the wastes during interim storage in the double-shell tanks. The liquid waste sampling, laboratory analysis, and compatibility evaluation are performed before pumping and interim stabilization of the tanks occur. These efforts are the initial steps of the interim stabilization and isolation process.

The waste analysis plan is presented in the following main sections: (1) Introduction, (2) Facility Description and Waste Description, (3) Identification of Wastes to be Managed, (4) Parameters to be Monitored, (5) Waste Sampling and Analysis, (6) References, and (7) Glossary. The appendices to these sections include a list of potentially incompatible wastes and a description of the quality assurance and quality control program. The waste analysis plan will be revised to ensure that changes in these areas remain current.

LIST OF TERMS

AL	analytical laboratories
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCRT	double-contained receiver tank
DSC	differential scanning calorimetry (analysis)
DST	double-shell tank
EDTA	ethylenediaminetetraacetic acid
EHW	extremely hazardous waste
EPA	U.S. Environmental Protection Agency
FY	fiscal year
HEDTA	hydroxyethylenediaminetriacetic acid
HPT	health physics technician
ICP	inductively coupled plasma
MW	mixed waste
NPH	normal paraffin hydrocarbon
PCL	Process Chemical Laboratories
PFP	Plutonium Finishing Plant
PUREX	plutonium-uranium extraction
RCRA	Resource Conservation and Recovery Act of 1976
REDOX	reduction-oxidation (process)
SST	single-shell tank
TBP	tributyl phosphate
TOC	total organic carbons
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic (waste)
WAC	Washington Administrative Code
WAP	waste analysis plan

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WASTE ANALYSIS PLAN FOR SINGLE-SHELL TANK COMPATIBILITY

1.0 INTRODUCTION

1.1 OBJECTIVE

This *Waste Analysis Plan for Single-Shell Tank Compatibility* describes the information that will be required to evaluate the compatibility of the pumpable liquid mixed waste (MW) within the single-shell tank (SST) underground waste storage tank system at the Hanford Site. The SST waste refers to defense MWs stored in 149 underground, carbon-steel-lined concrete tanks in the 200 Area of the Hanford Site that has been designated as extremely hazardous waste (EHW) in the tank farm *Resource Conservation and Recovery Act of 1976* (RCRA) Part A permit. Although the wastes are considered MW and EHW until proven otherwise by additional information, some of the wastes may not be hazardous. The scope of the work defined will describe (1) the waste sampling procedure, (2) the analyses to determine whether the pumpable wastes are complexed or noncomplexed and transuranic (TRU) or non-TRU, (3) the procedure to determine the TRU resolubilization potential of waste that is complexed or noncomplexed and non-TRU, and (4) the analyses for the radionuclides and physical properties of the pumpable waste.

This waste analysis plan (WAP) is based on RCRA and focuses on radionuclide issues. It addresses the applicable topics described in the requirements for WAPs as defined in Washington Administrative Code (WAC) 173-303-300 (Ecology 1989). In addition, recommendations from the U.S. Environmental Protection Agency (EPA) documents--*Waste Analysis Plans (A Guidance Manual)* (EPA 1984), and *Permit Application Guidance Manual for the General Facility Standards of 40 CFR 264*, (EPA 1983)--were also used to develop the present WAP. The intention is to analyze a complex, aged MW originating from the separation processes and support facilities that operated between 1944 and 1980. The standard RCRA waste compatibility and incompatibility concerns are addressed before their transfer to the SSTs. Section 4.1 further discusses this issue.

1.2 APPROACH

The following sections describe information required to evaluate the SST waste.

- Section 2.0 describes the SSTs, their associated wastes, and the background of waste generation.
- Section 3.0 identifies the wastes that are applicable to the WAP.

- Section 4.0 discusses of the chemical and radioisotope parameters that have been selected for analysis, as well as the rationale for their selection. A list of the standard waste compatibility analyses for SST liquid waste and potential incompatible wastes are also discussed.
- Section 5.0 illustrates the current waste sampling plan and the approach that is being used for representative sampling. It also describes the testing procedures used to analyze the SST wastes and identifies areas where procedures may be necessary to obtain reliable testing results and to permit safe and efficient handling of radioactive wastes.
- Section 6.0 presents a list of the references.
- Section 7.0 describes specialized terms with accompanying definitions.
- Appendix A describes potential incompatible wastes.
- Appendix B describes applicable quality assurance and quality control areas.

1.3 DATA REQUIREMENTS

The SST wastes contain a complex mixture of radioactive and chemically hazardous constituents (see Section 2.0). If waste from an SST will be transferred through the Plutonium Finishing Plant (PFP) interim storage tank (244-TX DCRT), the samples will be analyzed differently than those SST wastes that will not be transferred through this receiver. Occasionally, mixing tests will be performed on SST waste with neutralized PFP waste to determine the TRU resolubilization potential.

2.0 FACILITY AND WASTE DESCRIPTION

2.1 FACILITY DESCRIPTION

Between 1943 and 1964, 149 SSTs were built in the 200 West and 200 East Areas of the Hanford Site for the storage of radioactive wastes. These SSTs are located in 12 tank farms with 4 to 18 tanks in each farm. No wastes have been added to the tanks since November 1980. However, water is added to two of the tanks for heat management purposes. Pumpable interstitial liquid and supernatant wastes are removed from SSTs and transferred to double-shell tanks (DST) for interim storage. The DSTs are a tank-in-tank design and were placed into service beginning in 1971.

One hundred and thirty-three of the SSTs are 75 ft in diameter and 29.75 to 54 ft high (at their highest point) with nominal capacities of 500,000 to 1,000,000 gal. Sixteen of the tanks are smaller units of a similar design (i.e., 20 ft in diameter and 25.5 ft high with capacities of 55,000 gal).

The SSTs are constructed of carbon steel, American Society for Testing and Materials (ASTM) A238 Grade C or ASTM A201 Grade C (241-AX Tank Farm), that line the bottom and sides of a reinforced-concrete shell. Most of the tanks are dished slightly at the bottom. The tanks are below grade with at least a 6-ft-deep layer of soil cover that provides shielding and minimizes radiation exposure to operating personnel. Inlet and overflow lines are located near the top of the steel liner. Most of the 500,000- and 750,000-gal tanks were built in "cascades" of three or four tanks. Waste was transferred to the first tank of the cascade and allowed to overflow into successive tanks of the cascade through piping in the side walls.

Access to the tanks is provided by risers penetrating the dome of the tanks. Risers vary in diameter from 4 to 42 in. The tanks have a maximum of 11 risers, with the majority having 3 to 5 risers, potentially available for sampling. However, the actual number of existing risers that can be used for sampling will be less.

2.2 WASTE DESCRIPTION

Most of the wastes stored in SSTs were generated by the following chemical processing operations:

- Bismuth Phosphate ($BiPO_4$) Process (1944-1956)--The $BiPO_4$ process was a carrier-precipitation, chemical-separation scheme for the recovery of plutonium from irradiated reactor fuels.
- Reduction-Oxidation (REDOX) Process (1951-1967)--The REDOX process used solvent extraction with methyl isobutyl ketone (hexone) to recover and separate uranium and plutonium from the irradiated reactor fuel.

- Plutonium-Uranium Extraction (PUREX) Process (1955-1972)--The PUREX process uses solvent extraction with tributyl phosphate (TBP) to recover and separate uranium and plutonium from irradiated reactor fuel.

- Tributyl Phosphate Process (1952-1958)--The TBP solvent-extraction process was designed to recover uranium from stored waste generated by the $BiPO_4$ process.

- B Plant Waste Fractionation Process (1965-1976)--The B Plant waste fractionation process separated strontium and cesium, including the heat-generating ^{90}Sr and ^{137}Cs isotopes from the fuel reprocessing wastes.

The PUREX and REDOX processes used various reducing and oxidizing agents to control the valence state of the actinides. The REDOX and PUREX processes are the second- and third-generation chemical processes that recovered plutonium, uranium, and neptunium from irradiated reactor fuel. Before transferring the waste to the SSTs, sodium hydroxide or sodium carbonate was added to make the wastes alkaline to minimize tank corrosion. Sodium nitrite and nitrate have been added to some wastes to control tank corrosion. Thus, the processing of the irradiated fuels and treatment of the resulting waste have produced alkaline solids and liquids containing radionuclides and hazardous chemical constituents.

Other wastes that were sent to the SSTs in smaller volumes include research and development program wastes, facility and equipment decontamination wastes, laboratory wastes, and PFP wastes. The PFP uses a TBP solvent extraction process to further purify the plutonium product from the PUREX Plant or from plutonium scrap. The TBP in the PFP process is diluted in carbon tetrachloride, whereas the TBP in the PUREX Plant process is diluted in normal paraffin hydrocarbon (NPH) that is similar in composition to kerosene with C_{10} to C_{15} hydrocarbon chains.

Waste management operations have created a complex mixing of the tank wastes. Nonradioactive chemicals have been added to the tanks and different amounts of waste and heat-producing radionuclides have been removed. In addition, natural processes have caused settling, stratification, and segregation of waste components. Waste also was cascaded through a series of tanks. The cooling and precipitation of radionuclides and solids occurred in each tank of the cascade. As a result, it is very difficult to estimate from operation records the precise character of the wastes contained in each of the tanks.

The SSTs contain three general waste types: sludge, saltcake, and liquid. Sludge consists of the solids (hydrous metal oxides) precipitated from the neutralization of acid wastes before being transferred to the SSTs. Saltcake consists of the various salts formed from the evaporation of alkaline waste. Liquids exist as supernatant and interstitial liquid in the tanks. These waste types do not necessarily exist as obvious layers, but are mixed in different degrees. Sludge and saltcake may contain interstitial liquids and may be relatively soft. Other saltcakes and sludges may be drier and harder. Sludge, saltcake, and liquid are used as general descriptions and classifications of a waste. One waste form does not imply that the waste does not contain any of the other waste forms.

The SST wastes consist primarily of sodium hydroxide; sodium salts of nitrate, nitrite, carbonate, aluminate, and phosphate; and hydrous oxides of iron and manganese. The radioactive components consist primarily of fission product radionuclides such as ^{90}Sr and ^{137}Cs and actinide elements such as uranium, plutonium, and americium.

3.0 IDENTIFICATION OF WASTE TO BE MANAGED

Interim stabilization involves the removal and transfer of pumpable supernatant and interstitial liquid from the SSTs to the DSTs to minimize the spread of contamination if a tank begins to leak. Current criteria for interim stabilization require a tank to have less than 5,000 gal of free-standing supernatant or less than 50,000 gal of drainable interstitial liquid. Completion of interim stabilization and isolation is scheduled for fiscal year (FY) 1996, in accordance with the *Hanford Federal Facility Agreement and Consent Order* (referred to as the Tri-Party Agreement) interim Milestone M-05-09 (Ecology et al. 1989).

Before stabilizing a tank, the transfer lines between the SST and DST farms are flushed with water to prevent the residuals mixing with the next waste transfer. An analysis of the pumpable SST liquid is also required. Figure 3-1 shows a logic diagram for TRU evaluation and storage of SST liquid waste. If the liquid waste is found to be TRU or complexed, pumping is deferred until all non-TRU or noncomplexed liquid waste is transferred. If the waste is found to be non-TRU and noncomplexed, a waste mixing test may be required before pumping is approved. The deferral of pumping for complexed or TRU waste will not prevent meeting the Tri-Party Agreement milestones.

Boundary conditions have been established to ensure that the SST waste and residual waste in the double-contained receiver tanks (DCRT) and vaults are compatible. The SST liquid waste, upon entering and leaving the interim storage tank, must remain non-TRU (<100 nCi/g), and noncomplexed (<10 g/L total organic carbons [TOC]). These conditions were established based on experience with mixing SST waste with the PFP DCRT residuals and its potential for resolubilization.

The purpose of performing the waste mixing test is to determine the TRU resolubilization potential of selected non-TRU supernatant. For example, the transfer of SST supernatant from the 241-T Farm requires routing the liquid waste through the 244-TX DCRT, which is suspected to contain residual neutralized waste from the PFP. The neutralized PFP waste contains non-TRU supernatant and precipitated TRU solids. The mixing of these wastes has potential for resolubilization of the TRU radionuclides and production of additional TRU supernatant for segregated storage in the DSTs.

The chelating agents in SST waste promote solubility of TRU radionuclides, alter salt crystal formation and slurry viscosity during waste evaporation, and produce potentially flammable gas mixtures (Delegard 1980) during their degradation. The generation of gas mixtures results in slurry growth and the formation of floating crusts during storage in the SSTs or DSTs. Ethylenediaminetetraacetic acid (EDTA), hydroxyethylethylenediamine-triacetic acid (HEDTA), and hydroxyacetic acid were the predominant chelating agents used in the waste fractionization process. They were routed to the SSTs for storage.

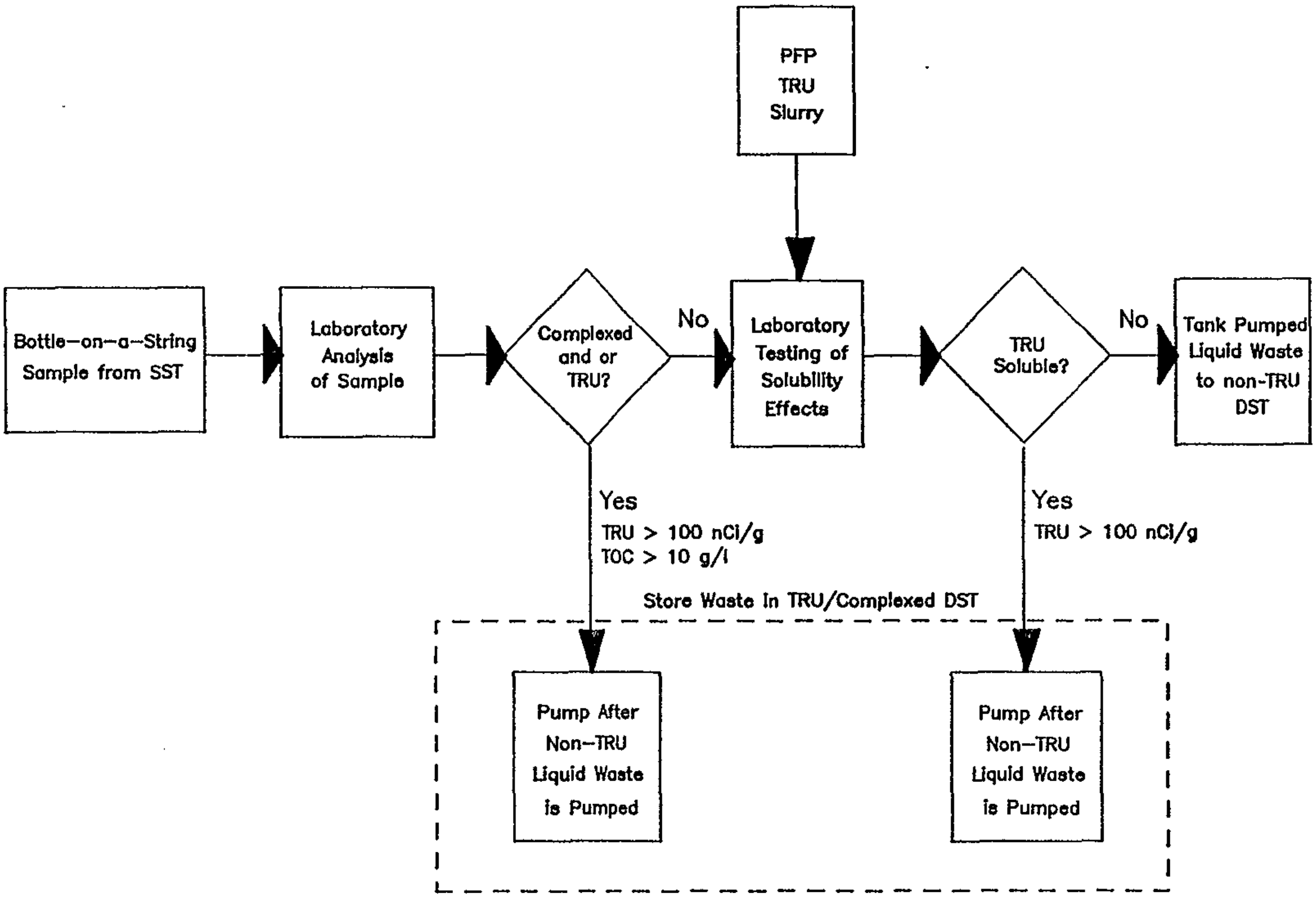

Figure 3-1. Logic Diagram for Single-Shell Tank Pumping Decision.

4.0 PARAMETERS TO BE MONITORED

4.1 INTRODUCTION

The pumpable SST waste must be analyzed to obtain the information needed to evaluate the pumping schedule and interim storage of SST waste in DSTs (described in Section 2.0). This section describes the chemical and radionuclide parameters that will be required for evaluating compatibility and explaining the rationale behind the decisions to look for particular characteristics of the SST waste.

The waste constituents of most concern will be those that are mobile, soluble, long-lived, or that pose a threat to human health and the environment. A wide variety of physical, chemical, and radioisotopic parameters of the SST waste must be known to maintain up-to-date tank information. This information will be useful in the grout and vitrification processing of SST liquid waste.

A list of the standard waste compatibility analysis performed on SST liquid samples at the Hanford Site are listed below:

- Physical Properties
  - pH
  - Specific gravity
  - percent water
  - Cooling curve--volume percent bulk solids versus temperature.

- Chemical Composition
  - Differential scanning calorimetry analysis (DSC)
  - Chelating agents, as required
    - EDTA
    - HEDTA
    - hydroxyacetic acid
  - OH^- ($\underline{M}$)
  - NO_3^- ($\underline{M}$)
  - NO_2^- ($\underline{M}$)
  - CO_3^{-2} ($\underline{M}$)
  - SO_4^{-2} ($\underline{M}$)
  - PO_4^{-3} ($\underline{M}$)
  - F^- ($\underline{M}$)
  - Cl^- ($\underline{M}$)
  - TOC (g/L)
  - Inductively coupled plasma (ICP)
    - metal ions.

- Radionuclides
  - Total alpha
  - Total beta
  - ^{241}Am (in liquid phase and total sample)
  - $^{239-240}Pu$ (in liquid phase and total sample)
  - ^{90}Sr
  - ^{99}Tc
  - Gamma energy analysis
    - ^{137}Cs
    - Other significant gamma-emitting radionuclides.

This compatibility list is for liquid samples only. The analyses are required for waste transfer and interim storage in the DSTs by Tank Farm Process Engineering. All Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), RCRA, and WAC regulatory requirements are addressed in the *Waste Characterization Plan for the Hanford Site Single-Shell Tanks* (Winters et al. 1989). The Code of Federal Regulations (EPA 1980) lists "Examples of Potentially Incompatible Waste." These potentially incompatible waste constituents and materials (Appendix A) have been addressed at each facility before processing and discharge of waste into the SSTs.

For example, metal fuels were declad and dissolved in specially designed equipment under controlled conditions to produce an acidic solution. The dissolved plutonium and other special nuclear materials were separated and purified in specially designed equipment under controlled conditions. The separation equipment was located in a different part of the facility. The acidic reprocessing wastes were neutralized before discharge to the SSTs. Reactive chemical constituents, such as nonaqueous phase liquid (e.g., solvent extraction organic) from the chemical processing operations, were discharged to specially designated underground cribs for soil retention rather than to the SSTs.

Some potentially reactive chemical constituents, such as ferrocyanide and water soluble organic chelating agents, have been discharged to the SSTs from past operations. The chemical stability of the wastes containing ferrocyanide and the chemical degradation products (gases) of the soluble organics are under study. A document on the chemical stability of these wastes is being prepared.

4.2 CHEMICAL TEST PARAMETERS

Analytical testing capabilities and constraints are a type of rationale that influence testing decisions. Because the SST waste is radioactive, waste analyses must be performed in hot cells and shielded hoods. Tests that can be performed quickly and that simultaneously provide data on a number of constituents will normally be performed more frequently than tests that only provide data on a single constituent. Any deviation from the approved procedure for waste analysis requires approval by Ecology. It is not reasonable to perform tests for constituents that are not expected to be present because it will result in unnecessary radiation exposure to personnel.

4.3 RADIOCHEMICAL TEST PARAMETERS

Radionuclide and organic chemical concentrations must be measured to classify the SST wastes as either TRU, complexed, non-TRU, or noncomplexed waste. In general, long-lived isotopes with high solubility and mobility are important to performance assessments and future compliance with applicable regulations.

The isotopes can be further categorized based on their primary source of production (e.g., fission product, activation product, daughter product, reactor fuel), half-life, and type of radiation emitted (e.g., alpha, beta, gamma, neutron). The type of radiation emitted is important in selecting the measurement procedure. The isotope concentrations in SST waste can be determined by direct measurement or from calculations based on the direct measurement of other isotopes. The method used for an isotope depends on the concentration of the isotope in the waste, the limitations of the radiochemical methods available, and its systematic relationship to other easily quantified isotopes.

Radionuclide analysis is one of the most manpower-intensive tasks in characterizing SST wastes, particularly for alpha- and beta-emitting isotopes that require lengthy chemical separations before counting for measurement. The analysis of trace isotopes in the presence of much higher concentrations of other isotopes normally will increase the uncertainty in the analysis.

5.0 WASTE SAMPLING AND ANALYSIS

5.1 INTRODUCTION

This section identifies the procedures to sample and measure the waste analytes and parameters described in Section 4.0. The sampling procedures are described in *Test Methods for Evaluating Solid Waste*, SW-846 (EPA 1986). The procedures for analysis of the constituents and properties listed in Section 4.1 are described by Winters (1989). The information is used to evaluate solubility and compatibility, and to ensure that the SST waste meets the specifications for interim storage in the DSTs.

It is the general intent to use the SW-846 procedures or other nationally recognized procedures whenever possible. However, these procedures do not always describe methods for measuring specific radionuclides and other components of the waste. These procedures also may not be directly applicable to Hanford Site waste matrices and may require modification or alternate methods for reliable results to control radiological exposure and contamination. Westinghouse Hanford Company laboratories are in the process of implementing and testing SW-846 procedures on the Hanford Site waste. Deviations from approved procedures for waste analysis require approval by Ecology.

5.2 SAMPLING

The liquid waste is sampled within 1 yr of pumping, using the "bottle-on-a-string" method. If the tank has a saltwell screen, the sample will be collected inside the screen. The saltwell screen sample is considered to be interstitial liquid and may represent the entire liquid content of the tank. If the tank does not have a screen, a sample will be taken through a riser at a minimum of 6 in. below the liquid surface level. A sample is taken at each liquid layer in the SST. Each sample is labeled separately for analysis.

Additional sampling of the pumpable waste may be required to confirm the initial TRU, TOC, and chemical component concentrations for interim storage of the waste in the DST. The additional sampling would occur in the DCRT.

The liquid is sampled with a device that consists of a sample bottle that is attached to a 2-in-diameter beveled pipe sleeve with stainless-steel wire, all of which are nonreactive to the chemicals in the waste tank. The capped sample bottle and riser are washed with warm water after collection of the sample. It is removed from the liquid sampling assembly and transferred into an inert plastic bag and then sealed. In accordance with supervision and health physics technologist instruction, the bag is placed into a sample pig and transported to the Process Chemical Laboratories (PCL) for analysis.

To protect personnel and the environment from contamination, all sampling is done within the confines of a radiological containment device (transportable greenhouse). All personnel must be qualified to work within this area. The nuclear operators who are responsible for sampling are recertified every 2 yr. Scientific literature and previous work history have been reviewed to identify any needs for special liquid waste-handling procedures during sampling. This ensures the protection of the employees and that the samples remain representative during storage.

Table 5-1 summarizes the previously described sampling procedures.

Table 5-1. Current Sampling Procedures.

Containment device	Single-shell tanks
Sampling technique	Bottle-on-a-string
Sampling device	100-mL glass bottle inserted into and attached to a 2-in-diameter beveled-steel pipe sleeve by a stainless steel wire. Sample suspension line is string or wire.
Number of samples taken	One: Subsurface liquid sample for each known liquid layer in the tank
Comments	1. Wear waterproof hand protection. 2. If determined by an HPT, face shield, self-contained breathing apparatus, and double protection apparel are required. 3. Finger ring dosimeters are to be worn by sampling personnel. 4. Ensure sampling ventilation is adequate. 5. Determine if sufficient tank vacuum is present to prevent high pressure alarm. 6. Place sample in plastic bag and then into sample pig container.

5.3 ANALYSIS

The scope of work involves determining the soluble TRU content of pumpable waste in the SSTs, then determining the TRU resolubilization potential of the SST waste that will be mixed or stored with TRU solids. If the waste is TRU or complexed, then pumping of the SST will be postponed until pumping of all non-TRU and noncomplexed SST waste is complete. If the TRU has not resolubilized after mixing, the liquid will be pumped to non-TRU/non-complexed storage.

For the mixing test, a sample of PFP high salt waste from the solvent extraction column is analyzed by the PFP Laboratories for ^{239,240}Pu total

For the mixing test, a sample of PFP high salt waste from the solvent extraction column is analyzed by the PFP Laboratories for $^{239,240}Pu$ total alpha, and a caustic demand number of 1.8M. It is then neutralized by the PCL, according to the PFP caustic demand number, to mimic the PFP operating procedures, and then dosed with ferric nitrate to help precipitate TRU. The intent is to generate a non-TRU liquid waste-TRU solids slurry for mixing with the non-TRU liquid waste from the SST. The neutralized PFP waste is mixed with an equal volume of sample liquid. The samples are agitated (using a stir bar), and aliquots are removed after 1, 3, 6, 13, and 21 days of mixing. The aliquots are analyzed for TRU and chemical components that promote TRU solubility. Quality assurance and quality control procedures for waste analysis are discussed in Appendix B.

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7.0 GLOSSARY

compatibility of waste - the degree to which complexed and transuranic waste and noncomplexed and nontransuranic wastes are segregated.

complexant concentrate - a waste resulting from the concentration of dilute complexant waste to the point of solids formation. When solids are formed, the viscosity of the complexant concentrate increases very rapidly.

complexed waste - the dilute waste material that contains relatively high concentrations of chelating agents, such as ethylenediaminetetraacetic acid (EDTA) and hydroxyethylenediaminetriacetic acid (HEDTA), from the B Plant waste fractionization operation. It may contain soluble transuranic (TRU) elements such as plutonium and americium.

noncomplexed waste - a general waste term applied to all Hanford liquors not identified as complexed.

nontransuranic - waste that contains <100 nCi/g.

pumpable waste - the liquid mixed waste that is to be pumped from the unstabilized SSTs before September 1996 to meet the milestones of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement).

resolubilization potential - tendency for precipitated transuranic components to solubilize after mixing with non-TRU waste solution.

single-shell tank underground waste storage tank system - the transfer lines and receiver vaults that are used for interim storage of pumpable liquid waste from the SSTs.

transuranic - waste that is contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 yr and concentrations greater than 100 nCi/g.

transuranic radionuclide - any radionuclide having an atomic number greater than 92.

APPENDIX A

POTENTIALLY INCOMPATIBLE WASTES

The Code of Federal Regulations (EPA 1980) lists "Examples of Potentially Incompatible Waste." The list has been replicated below. In the following lists, the mixing of a Group A material with a Group B material may have the potential consequence as noted.

Group 1-A

Acetylene sludge
Alkaline caustic liquids
Alkaline cleaner
Alkaline corrosive liquids
Alkaline corrosive battery fluid
Caustic wastewater
Lime sludge and other corrosive alkalies
Lime wastewater
Lime and water
Spent caustic

Group 1-B

Acid sludge
Acid and water
Battery acid
Chemical cleaners
Electrolyte acid
Etching acid liquid or solvent
Pickling liquor and other corrosive acids
Spent acid
Spent mixed acid
Spent sulfuric acid

Potential consequences: heat generation and violent reaction

Group 2-A

Aluminum
Beryllium
Calcium
Lithium
Magnesium
Potassium
Sodium
Zinc powder
Other reactive metals and metal hydrides

Group 2-B

Any waste in Group 1-A or 1-B.

Potential consequences: fire or explosion and generation of flammable hydrogen gas.

Group 3-A

Alcohols
Water

Group 3-B

Any concentrated waste in Groups 1-A or 1-B
Calcium
Lithium
Metal hydrides
Potassium
SO, Cl, SOCl, PCl, CH, SiCl
Other water-reactive waste

Potential consequences: Fire, explosion, or heat generation of flammable or toxic gases

Group 4-A

Alcohols
Aldehydes
Halogenated hydrocarbons
Nitrated hydrocarbons
Unsaturated hydrocarbons
Other reactive organic compounds and solvents

Group 4-B

Concentrated Group 1-A or 1-B wastes
Group 2-A wastes
Potential consequences: fire, explosion, or violent reaction

Group 5-A

Spent cyanide and sulfide solutions

Group 5-B

Group 1-B wastes
Potential consequences: Generation of toxic hydrogen cyanide or hydrogen sulfide gas.

Group 6-A

Chlorate
Chlorine
Chlorites
Chromic acid
Hypochlorites
Nitrates
Nitric acid, fuming
Perchlorates
Permanganates
Peroxides
Other strong oxidizers

Group 6-B

Acetic acid and other organic acids
Concentrated mineral acids
Group 2-A wastes
Group 4-A wastes
Other flammable and combustible wastes
Potential consequences: Fire, explosion, or violent reaction.

Reference

EPA, 1980, *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Title 40, Code of Federal Regulations, Part 264, as amended, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX B

QUALITY ASSURANCE AND QUALITY CONTROL PROGRAM

B.1 PROGRAM GOAL

Westinghouse Hanford Company's interim stabilization and isolation goal is to obtain accurate and precise single-shell tank (SST) waste data that results from sampling and analysis of the pumpable liquid. The analytical data are obtained to verify the current pumping strategy and projected double-shell tank (DST) storage space requirements or identify required changes to the baseline plans based on sample results. The procedures for the waste analysis plan (WAP) will be performed in accordance with the following: (1) sampling of the non-aging waste tanks will follow the Job Control System operating procedures for non-aging SSTs, (2) analytical laboratory (AL) liquid samples will use the guidelines established in the standard operating procedures, and (3) Process Chemical Laboratory (PCL) liquid samples will follow approved desk instructions.

The amount of data needed to guarantee compatibility is fixed. Many underground storage tanks contain low-level or transuranic (TRU) hazardous waste. These tanks contain a combination of sludge, liquid, and/or saltcake. The onsite PCL and AL analyze three parameters in the SST sample--physical properties, chemical compositions, and radionuclide concentrations.

B.2 SAMPLING PROGRAM

The SST sampling personnel have been properly trained to sample the waste, using the equipment described in Section 5.0 of this WAP and by following the plant operating procedures for non-aging waste storage tanks. The nuclear operators, who are recertified every 2 yr, are constantly monitored by a health protection technician while sampling. The equipment used is set up and inspected the day the testing is requested. When samples are taken, the operator logs the vital data on the "Supernatant Sampling Data Sheet" (see Figure B-1), labels the container, and prepares the shielded sample container for transport to the 222-S Laboratory. After the sample has been taken, the bottle and string are decontaminated as directed by the plant operating procedures. The operator prepares a request for analysis; this request accompanies the sample to the laboratory to specify waste samples and analytical data needed.

Figure B-1. Supernatant Sampling Data Sheet.

PRESAMPLING INFORMATION

DATE ____________
TANK NUMBER ____________
TANK LIQUID LEVEL ____________
SAMPLE RISER NUMBER ____________
DISTANCE FORM RISER FLANGE TO SAMPLE DEPTH ____________
SAMPLING DEPTH FROM TANK BOTTOM ____________

OPERATOR'S SIGNATURE: ______________________ DATE: ________________

SAMPLE PIG INSPECTION

SAMPLE PIG SERIAL NUMBER ____________
LOCKING PIN ON PIG OPERABLE ____________
SAMPLE PIG LID O.K. ____________
SAMPLE PIT FREE OF VISUAL DAMAGE ____________
SAMPLE PIG INTERNAL CAVITY FREE OF FOREIGN MATERIAL ____________
SAMPLE BOTTLE FITS INTO SAMPLE PIG ____________

OPERATOR'S SIGNATURE: ______________________ DATE: ________________

SAMPLING INFORMATION

SAMPLE NUMBER ____________
SAMPLE, CONTACT RADIATION READING ____________
SAMPLE PIG RELEASED BY HPT FOR PACKAGING ____________
(RELEASE TAG AND SAMPLE IDENTIFICATION)

OPERATOR'S SIGNATURE: ______________________ DATE: ________________

PIG PACKAGING IN SHIPPING CONTAINER

LID IN PLACE/LOCKING PIN INSTALLED ____________
SAMPLE TAG AND RADIATION STICKER ATTACHED ____________
RPT SURVEY/TAG ____________
ABSORBENT MATERIAL AROUND PIG ____________
O-RING UNDAMAGED ____________
LUBRICATED O-RING ____________
FLANGE FACES UNDAMAGED/CLEAN ____________
NUTS ON CONTAINER TIGHTENED ____________
SAMPLE IDENTIFICATION LABEL AND RPT RELEASE TAG ATTACHED ____________
LABORATORY AND TFSA NOTIFIED ____________

DATE/TIME SAMPLE PIG SHIPPED - DATE: ______________ TIME: __________

OPERATOR'S SIGNATURE: ______________________

SUPERVISION REVIEW SIGNATURE: ______________________ DATE: __________

B.3 ANALYSIS PROGRAM

All analytical procedures that pertain to waste compatibility testing have been specified by the AL and the PCL. Both the AL and PCL are operated in the 200 West Area by qualified, trained analysts. The analysts follow general procedures, U.S. Environmental Protection Agency (EPA) procedures, and SW-846 procedures[1] when more stringent instructions are required. The laboratories maintain a rigorous quality assurance and quality control program, which is available for review by EPA upon request. The very reactive components are analyzed within 48 h, organics within 14 d, and anions and metal ions within 6 mo of sampling. All analytical data are documented, returned to tank farm plant engineering for evaluation, and filed in the tank farm history files.

The AL personnel analyze routine samples (i.e., liquid-only samples). Nonroutine analyses (e.g., a solid-liquid sample) are performed by the PCL. The PCL prepares the solid-liquid sample into a liquid state for AL analysis.

The laboratory equipment used is inspected and serviced according to the manufacturer's recommendations. The analytical balances are calibrated once each month. All leftover and analyzed sample material is transferred directly to Double-Shell Storage Tank 241-SY-102.

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[1]EPA, 1986, *Test Methods for Evaluating Solid Waste*, SW-846, Rev. 0, U.S. Environmental Protection Agency, Washington, D.C.

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